CONSTRUCTION AND EVALUATION OF A TOY FOR PRESCHOOL CHILDREN

by

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The researcher created a wheel toy with reference to the developmental needs of children. It was pretested and tested. Subjects were 36 children, equally distributed according to age and sex, three, four, and five years old. The toy was essentially a rolling cylinder with wheels attached at either end, integral with the center section.

A thirty-minute get-acquainted period preceded the three thirty minute data gathering periods for each age group. Subjects used the toy in free play and in conjunction with schoolroom toys. The toy had two positions, vertical and horizontal.

Objectives of the study were to determine the children's interest in the toy in terms of time used. Categories were: how much of the available play time the toy would be used; whether children in all age and sex categories would vary significantly in their overall use of the toy, and in the time they used the toy in either vertical or horizontal position; how the children conceived the toy while using it; and what schoolroom toys would be used in conjunction with it.

A diary data collection sheet was used for recording data. To determine the significance of differing amounts of time that age and sex groups used the toy in the research categories, the Mann-Whitney Two-Tailed U Test (a non-parametric statistic) was employed.

Results showed the toy was used 100 per cent of available play time. Differences in time that boys and girls of all ages used the toy were non-

significant. Differences of time that three-year-old children used the toy vertical or horizontal also proved non-significant, though differences in these categories were significant for ages 4 and 5.

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Chapter 1

Introduction

Throughout history there has been a need for the fashioners of children's toys to design them in keeping with the developmental needs of children. With the increasing volume, force, and complexity of our culture there is a heightening need for toymakers to be aware of children's needs in toy design, rather than to use as a guide those that are already on the market.

Not enough attention has been given to the benefits the playing child could receive from his toys, in contrast to a mere short-lived and shallow attractiveness. With our culture's capacity for manufacture and for creating appetitive desires, children may be subjected to toys which are inimical to their innate and cultural developmental needs. Very likely more and more research is being done with the interests of children in mind, and these studies should continue and grow in numbers and extent.

Toys should not only emphasize in their design the easily-recognized needs of children; they should also include a simplicity of design so that the toy may fit into the child's personal evolution, rather than act as an end in itself.

Toys are inventions. Through visual, tactile, auditory, and even olfactory senses, they help to objectify reality for the child. In response to his sense of reality, the child develops his muscles, his senses; he perfects his

skills, his attitudes; he evolves personally on an ever-enlarging scale. Through interaction he learns cooperation with things and people.

All through the ages children have played with something, from sticks, stones, crude carvings--to the present day when the artifacts of our culture are very highly developed. Then, as now, playthings helped to draw from the primeval and perennial storehouse of abilities which each individual possesses.

The forcefulness of our culture today puts particular emphasis and strain upon the abilities and opportunities of every child. A fresh awareness is called to those innate and cultural factors which every child faces in his development. Each child should develop his innate capacities to be used in the culture, so that he may recognize and enjoy the synthesis of his powers with the work of the world, or as Ortega Y Gasset has said: "The world as pure mechanism would be the machine of the machine. Man must realize himself in the world." (Hils, 1961, p. 69). The present study is an effort to design one toy and test it with groups of children three, four, and five years of age.

The Problem

In order to approach the study of a toy and children, certain preliminary actions were taken. They included a statement of the problem, objectives, definitions, limitations, and hypotheses. There was an awareness of assumptions.

Statement of the Problem

The problem was the construction and evaluation of a toy for preschool

children.

Objectives

The objectives of the study were: (a) to create an educational toy for preschool children, and (b) to study its use with children three, four, and five years old.

Definitions

Some of the terms used throughout the study were:

Preschool Children. Children three to six years of age not enrolled in the first grade

Research Group. Any one of the three groups of children selected for the study

Observation Period. Any one of the 9 thirty-minute, free-play periods

Free Play. Play which received its direction and impetus from the children

The Toy. The play vehicle constructed for the study

Toy Position. Vertical or horizontal

Play. Active participation with the toy (proximate interaction), by any member of the research groups

Diary Data Collection Sheet. A form designed by the researcher for the purpose of recording: (a) the date, (b) the group, (c) the period, (d) the number of boys and girls present for the day, (e) the weather, (f) the amount

of time in minutes, that any boy or girl of a research group played with the toy in vertical or horizontal position, (g) the uses of the toy, (h) other toys used in conjunction with the toy, and (i) explanatory notes on the children's play.

Conditions for Observation

Conditions for observations were limiting in some respects: (a) subjects were limited to the children enrolled in the University of North Carolina at Greensboro Nursery School, and the St. Francis Episcopal Church Kindergarten of Greensboro, North Carolina, (b) observations were limited to 3 thirty-minute periods per research group, (c) observations were limited to the use of the constructed toy (not compared to commercially-built toys), (d) observations of the use of the toy were limited to indoor play in the regular classroom, and (e) observations were limited to those made by the researcher.

Hypotheses

The hypotheses for the study were: (a) there will be no significant difference in the amount of time that nursery school and kindergarten children use the toy, (b) there will be no significant difference in the amount of time that boys or girls use the toy, and (c) children's preference of the position of the toy (vertical or horizontal) will not vary significantly in terms of time used.

Importance of the Study

Play should be recognized as an absolute essential to physical and mental development. Through play the child develops his sense of adequacy, his sense of security, his feeling of value. He needs the challenge of real exploring, of certain elements of risk in the process of getting on his own.

Essential to these developments are things with which children interact, developing their capabilities, and learning to know their culture. In constructing a toy, one must consider in its design the nature and needs of the child.

Many toys of our present culture indicate a frivolous interest in the innate needs of children, and an emphasis upon the less valuable aspects of our culture. Thus an earnest search for toys which meet the developmental and cultural needs of children is in order.

Organization of Remainder of Thesis

Literature that is related to (a) theoretical explanations of play, (b) factors affecting the child's ability to play, (c) the history of wheel toys, (d) the responsibility of toymaker and parent, (e) toy design, (f) toy construction, and (g) research related to children's play, is reviewed in Chapter 2. Chapter 3 describes: (a) construction of the toy, (b) the child and the toy, (c) the subjects, (d) the play situation, and (e) method of data analysis. The analysis of data is presented in Chapter 4. Results are tabulated concerning time use of the toy by children, and how the children used the toy. A summary, conclusions, and recommendations are included in Chapter 5.

Chapter 2

Review of Related Literature

The literature reviewed for this study has been divided into the following sections: (a) theoretical explanations of play, (b) factors affecting the child's ability to play, (c) the history of wheel toys, (d) the responsibility of toymaker and parent, (e) toy design, (f) toy construction, and (g) research related to children's play.

Theoretical Explanations of Play

In order to develop the research along the lines proposed in the objectives, it was necessary for the investigator to have some understanding of the theory of play.

The Surplus Energy Theory

This theory is among the oldest, simplest, and most widespread theories, credited most frequently to Herbert Spencer (1873). Proponents of this view saw play as wasteful, and believed that if all useful tasks were finished first, there would be no surplus energy. However, children did, and will, play day in and day out, oblivious of even fatigue and hunger because they play until certain neuromuscular sections become weary, and then enthusiastically switch to another game which utilizes other sections. All organic beings

possessed of energy tend to be active. The surplus energy theory makes a contribution, yet fails to account for the form play takes, the fact that children around the world play in much the same ways, and the fact that play relaxes and restores (Mitchell and Mason, 1948, pp. 64-66).

The Recreation Theory

This theory closely follows the previous theory, stating essentially that after people have completed their labor, they need play and diversion. Experience has shown that even after adequate rest and sleep, a change to an active and interesting occupation is more restful than idleness, and that play recuperates and restores those mentally and physically tired. This theory advanced by G. T. W. Patrick (1916) is basically sound, yet it does not account for the pleasure derived from mental activity and intellectual play. It applies primarily to adults, not children. It neglects the very important role which habit plays in motivation (Mitchell and Mason, 1948, pp. 68-70).

The Instinct-Practice Theory

Karl Groos (1902), more than anyone, did an enormous amount of work in the area of instinct-practice theory. His theory was that instinctively the young individual plays in preparation for a later need. Primitive people particularly educated themselves through play toward abilities they would need later. However, with complex civilized peoples, this theory has been criticized in that the play of children is not a precise preparation for later occupations. Yet, if play is seen as leading to personal mastery of the physical self, coordination,

and other conditions, which make specialized movements and thoughts possible, the implications of this theory for physical and mental development are acceptable (Mitchell and Mason, 1948, pp. 71-73).

The Recapitulation Theory

Influenced by the strong onset of biological investigation, G. Stanley Hall (1904), explained play as the result of biological inheritance. He based his idea on the assumption that all play results from instinctual habits having their origins in the rudimentary functions of organs--instincts trained into the organs by previous generations. Thus, what the young do today is merely a recapitulation of what one's ancestors did, based upon physiological, instinctive needs.

Though Hall's theory has been discredited in many areas, there remains the truth, that humans cannot deny biological structures, including mental capabilities. Behavior is affected by culture, so that a position completely in favor of biological conditioning cannot be maintained. Hall's theory stimulated much beneficial research in the interest of children (Mitchell and Mason, 1948, pp. 74-76).

The Physiological Growth Theory

This theory grew out of Hall's ideas through the efforts of L. E. Appleton (1910), who held that play satisfies the needs of the growing body, that the physiological drive for growth initiates the drive for play in order to develop a function, and that when the function has been developed, the need for play in

that area subsides. Thus play leads to growth and is training for life (Mitchell and Mason, 1948, pp. 76-77).

The Catharsis Theory

This old theory was apparently first supported by Aristotle, and contends that play is a safety valve for pent-up emotions, and also serves as compensation for frustrations suffered in another area (Mitchell and Mason, 1948, pp. 77-79).

The Self-Expression Theory

This recent theory by Mitchell and Mason (1934), stated that the individual actively struggles to express that he is alive, has abilities, is a personality. These desires become powerful motives, functioning as drives, to give expression to one's wishes for a favorable personal identity--reflecting a sense of mastery. For the child, the spirit and energy that he puts into his play is essentially the same that he will put later into any work or enterprise that he likes (Mitchell and Mason, 1948, pp. 79-85).

Other Theoretical Aspects

Inherent in all play are powerful wishes, or desires. W. I. Thomas (1931), expressed them as: (a) the wish for new experience, (b) the wish for security, (c) the wish for response, (d) the wish for recognition. To these have been added: (e) the wish for participation, by Ellsworth Faris (1931); and in 1934 Mitchell and Mason, (f) the wish for the aesthetic, or beautiful (Mitchell and Mason, 1948, pp. 90-92).

Why and How Children Play

Children play against the oppositions of climate, location, materials, fatigue, hunger, and people. They become submerged in their play, unaware of other factors, being endowed by nature with this capacity. For children, play is their work, and while they enjoy it, they are quite business-like about it. The way in which they play becomes the foundation for more complex creative, emotional, social, and work patterns. A child's play activity is also a primary source of growth and coordination for his mind and body, and calls into action his full power of concentration and creative energy. As a result a sense of independence, imagination and taste develop. Children are natural-born scientists, constantly experimenting and exploring through trial and error. Sometimes there is more destruction than order, involving happy shouting, or a scattering of playthings in a fit of frustration. Sometimes the child's play is too much, or too little, of a challenge. At different times children want toys that are tiny in scale, or of generous proportions--the more uses to explore the better (Cherner, 1954, pp. 13-15).

Around age three, the child shows interest in a tricycle or wagon. He is undaunted by a swing or jungle gym. As he approaches age four, he becomes interested in more complicated and imaginary play, is a good climber, more ingenious with materials, and his friends now work with him. At five a boy is a great runner and climber, goes for rocket rides in his swing, tries to go at breakneck speed. Girls are becoming more feminine. By the age of six,

children show greater manipulative and coordinative skill. Falls, bruises, and cuts are less frequent. There is marked interest in getting along with one's peers, less difficulty in making themselves understood. Boys find wheel toys and transportation of major interest. Girls show keen interest in doll clothes and doll house furnishings (Cherner, 1954, pp. 10-20).

This section on play theory and characteristics of growing, playing children, lends background and insight for toy design and for testing the research toy with children.

Factors Affecting Children's Ability to Play

As each individual develops, he experiences a gradual transition from one period of life to another, with interests developing slowly through experience as his body changes. Exceptions and variations in the order of development are common between individuals, for example, some children talk before they walk--which is atypical (Mitchell and Mason, 1948, p. 171). A number of factors affect the performance and behavior of children as they develop and play.

Sex Differences

There are many differences in the behavior of the two sexes which affect leadership in play. These differences are due primarily to two factors: (a) difference in physiological structure and function, and (b) difference in social conditioning (Mitchell and Mason, 1948, p. 182).

Some physiological differences are: (a) boys have more muscular tissue and are able to withstand more strenuous effort; (b) boys have a metabolic level approximately 10 per cent higher than girls, which favors greater activity and aggressiveness; (c) girls' endocrine glands (thyroid and adrenal), function to a greater extent, causing a higher output of nervous energy and a smaller production of physical energy than boys (Mitchell and Mason, 1948, pp. 182-183).

The physiological differences between boys and girls are significant, but they are minor factors in behavior differences, compared to social conditioning. That social conditioning is important, in a broad sense, is illustrated by the changes in women's behavior since they have had opportunity to participate in activities outside the home. Girls are participating more and more in activities formerly the special sphere of boys. Girls have taken to athletics and outdoor sports with eagerness, once taboos were removed, and the opportunity to compete in games has aided them in developing improved attitudes of sportsmanship, a trait women did not have the opportunity to develop before (Mitchell and Mason, 1948, pp. 183-184).

Results of many studies indicated that males and females were much closer in their inborn intellectual and social capacities than had been assumed in the past. Regarding infancy as a state of teachability, it became evident that through a different type of training, e.g. organized play, the relative boisterousness, lack of sympathy, and destructiveness of boys, and the emotionality of girls could be remedied (Mitchell and Mason, 1948, pp. 184-185).

In the field of play, differences do not appear so much in the kind of play activity, as in the way boys and girls play. Boys are more vigorous, strenuous, and competitive than girls, and play more with a driving, winning spirit. In construction projects, girls tend to gravitate toward smaller, more delicate things. Boys seek large projects often mechanical in nature. These behaviors, in part, are the results of tradition and education, which begin to have strong influences when the child enters the first grade. Until then boys and girls are so nearly alike in ability and interest that they play and enjoy the same activities (Mitchell and Mason, 1948, p. 185).

Physical Factors

By age three, the average boy stands about 38 inches tall and weighs about 33 pounds. The average girl is almost as tall (37.6 inches), and nearly as heavy (32.5 pounds). As the result of gradual increases, the average five-year-old boy has attained a height of 43.6 inches and a weight of 42.8 pounds. At age five, the girl's measurements are roughly comparable, though a little smaller and lighter. The period of growth between ages three and five includes continuing growth of skeletal, muscular, and nervous systems. Up to about four years of age, growth in the muscular system is roughly proportional to body growth as a whole, but thereafter, the muscles develop faster, so that about 75 per cent of the child's weight increase in the fifth year can be attributed to muscular development. Thus the five-year-old child may be expected to be much stronger and more nearly developed physically than the two age groups preceding (Mussen, Conger, & Kagan, 1963, pp. 233-235).

Throughout the three to five year period the larger muscles are better developed than the smaller muscles, and are best suited to large movements. Individual differences occur in all areas of development. During this three to five age period, the child's endurance increases because respiration becomes deeper and slower, heart rate slows and becomes less variable, and blood pressure increases steadily. Thus the younger children may be expected to tire more easily and sooner than older children (Mussen, Conger, & Kagan, 1963, pp. 233-235).

Psychomotor Factors

Mussen, Conger, and Kagan stated that by age three, the traces of infantile motor behavior have all but disappeared. As a result of progressive neuromuscular maturation, the child runs with more smoothness, accelerates and decelerates with greater ease, turns sharper corners, and stops suddenly. He can go up stairs unaided, alternating his feet. He can jump down with both feet together, can jump up with both feet, as much as twelve inches. He is ready for a tricycle.

Mussen, Conger, and Kagan reported that by age four, the child's increasing psychomotor skills improve his capabilities. He can run more smoothly, is able to break up the regular rhythms of his stride, can make moderately good running and standing broad jumps. He can skip, but not hop. Because of the principle of individuation, leg, trunk, shoulder, and arm muscles operate more independently. Spatial orientation and movement has increased markedly over that of the three-year-old.

By five years of age, the average child has a fairly mature sense of balance which is exhibited by his more self-reliant abandon in motor behavior. He does everything better than he did at four; he can perform more fine movements (Mussen, Conger, & Kagan, 1963, pp. 235-236).

It is apparent that children, ages three to five, have the capability and skills to play with wheel toys. The individuals within the groups may be expected to vary in ability according to individual maturation.

Social Factors

Children imitate each other as early as fifteen to eighteen months of age. As early as two years of age, they play in a loose group, in parallel or independent play, but nevertheless imitative play. Children three to five years of age, enjoy looking at something together, or listening to a story together. They begin to like specific companions for the sake of companionship.

Around age four, children shift together in groups. By five or six, if children have had an opportunity to play with other children, rather closely woven play of an organized group develops spontaneously. From this group play comes the opportunity for the child to find himself in the group, to realize himself as a personality. The individual finds himself because others help define his meaning (Breckenridge and Vincent, 1963, pp. 485, 477-478).

Three-year-old children, though still self-absorbed, but given the proper opportunity to play with other children, are increasingly aware of others. Socialization proceeds, in spite of solitary and parallel play, in the form of learning to take turns at the swing or slide and in sharing toys. At

four years, children exposed to other children become aware of themselves as belonging to a group, and often show a wide repertory of social responses. These responses range from requests for assistance, to making suggestions, using techniques of acceptance, refusal, evasion, or transformation of a situation. Gradually children learn sympathy for another so that rudimentary kindness may be expressed by preschool children, depending upon the individual (Breckenridge and Vincent, 1963, p. 474).

At three or four years of age the child replaces physical aggressiveness as an anger response with name calling, bragging, boasting, making retorts, swearing, tattling, or using insinuations. Exclusion from the group is a popular form of group aggression against one or more offending group members. Socialization, or group play, increases steadily from preschool years, reaching a developmental peak in the early elementary school years. Quarrels increase as group play increases, since children, playing by themselves, are interrupted more in the fulfillment of their own ideas. With group contacts at a height, but with skill in social contacts only in the early stages, it seems clear that quarreling will be frequent and not too skillfully conducted. The important part of learning to maintain close personal contacts without quarreling takes place in later gang-age education (Breckenridge and Vincent, 1963, pp. 132-133).

Characteristics of Play

Today, work and play are not considered as diametrically opposed as formerly, but are seen as being so much alike that they often overlap, making

it difficult to tell the difference between the two. Play is seen more and more as an attitude of mind which may pervade any activity. The play of the adult is more a using of perfected skills, whereas the play of the child is a skill-perfecting process. Each age has its goals, for man is a goal-seeking creature--even though the goal may not always be a conscious one. Children spend most of their time in experimental activity of many forms. It is a serious matter, even though joy or pleasure is experienced in pursuing and accomplishing goals (Mitchell and Mason, 1948, pp. 105-108).

Play, of and for itself, has no serious consequences and thus provides excellent opportunities for trial and error learning. It is the type activity most enjoyed by children. Play which has aims beyond the play, such as winning a contest, or a friend, can have serious consequences--insecurity being one of them. Play for children must be guided so that there may not be too many failure possibilities in proportion to successes (Mitchell and Mason, 1948, pp. 108-116).

History of Wheel Toys

According to Hils, the toys and fragments of toys which were handed down through the centuries were almost invariably of clay, stone, bone, iron, or bronze, in short, made of durable materials. Toys made of wood, for example, crumbled away with the years, unless they happened to have been preserved in the dry atmosphere of such a country as Egypt, and few are the metal toys which have escaped the melting pot (Hils, 1961, p. 9).

Toymaking in all cultures seemed to have been the work of members

of families in one form or another. As an industry it first was organized in Nuremburg, Germany, sometime before 1500 A.D. By 1670 Holland (Utrecht) was also famous. In the New World, only after 1800 A.D., did toymaking acquire importance. Apparently the greatest emphasis up to this time was upon dolls and doll houses (Dongerkery, 1954, p. 21).

The great Exhibition of 1851 in Britain opened vast possibilities for all kinds of industries, including the toymaking industry. The great increase in toy novelty began about this time, and practically all toys were manufactured in Europe. The United States and Japan emerged as toymaking giants only in the Twentieth Century (Foley, 1962, pp. 117-120).

No one knows when the wheel was invented. Apparently among the first wheel toys were the wheeled horse and bird, of which numerous examples exist; also the two-wheeled cart, all dating more than 100 B.C. These designs have survived from the days of ancient China, Egypt, and India, through the Middle Ages to Modern Times (Hils, 1961, pp. 9-10).

Wheeled birds were found among objects belonging to the Bronze Age of Europe, and motifs of these were again to be seen in the art work of China during the Han period (206 B.C. to 220 A.D.). The wheeled bird found in Europe was supposed to belong to the period 1300 and 900 B.C., and that found in China to a period about 200 years before the Christian era. Apparently the wheeled bird of China had its source in Europe, possibly through India (Dongerkery, 1954, pp. 28-30).

During the eighteenth and nineteenth centuries the greatest number of

toys were distributed through Nuremburg which was the center of an area of home-toy industries composed mainly of peasants. Beginning very simply with home objects carved of wood, the workers rapidly evolved the complexity of their toys and their distribution, so that they produced the greater part of the toys over the entire world (Gröber, 1928, pp. 43-45).

The nineteenth century saw toymaking industrialized, moving from wood to metals, especially sheet metal. Gone was the individual mark of the craftsman who became a mere machine tender. Catalogues of this period (Bestelmeir's) showed wheeled toys in the form of wagons, coaches, canons, and various figures mounted on wheels or wheeled platforms (Gröber, 1928, pp. 55-58).

According to the McClintocks (1961), the first velocipede was invented by a Scottish blacksmith in 1839. The next year, 1840, the Crandalls of New England developed a velocipede, and continued improvements on the first clumsy affair for over forty years, their best model operated by a foot treadle. Accompanying this development in the same period, was the popular American Speeder, similar to the Irish Mail, which variously had three wheels, sometimes four, and was propelled by pedals or hand levers (McClintock, 1961, pp. 121, 152, 203, 312).

For decades after 1870, a wooden wagon built on the order of a horse-drawn vehicle with a seat on top "was a necessity for practically every boy." Also small two-wheeled carts and carriages with a long handle were popular at this time (McClintock, 1961, pp. 120, 123, 312).

Two-wheeled bicycles (both tall front wheel and equal-wheeled) were in general use in the United States about 1866, and were highly developed by 1888 (McClintock, 1961, pp. 229-230).

The spread of all manner of toys to the country as well as the city was greatly augmented by the mail order houses, Montgomery Ward (1872) and Sears Roebuck (1888). Great toy expositions in the United States and Europe during the last of the nineteenth century spurred public interest in toys in general (McClintock, 1961, pp. 349-350).

Comparing toy manufacturing of today with that of the late 1800's, one is impressed by the almost bewildering variety of toys in the early days. Present day production reflects a narrower line which must depend upon mass sales of relatively few items (McClintock, 1961, pp. 351, 357).

Just past the turn of the century, coaster wagons became a favorite for racing, and the light scooter came into use. The Irish Mail became popular, and toy automobiles, in imitation of adult cars of the day (propelled mainly by pedals), were introduced (McClintock, 1961, pp. 372-373).

Beginning in the 1920's new types of toys came into being--those developed from scientific testing done in nurseries and other preschools. Involved were psychologists, teachers, philosophers, doctors, and parents, each seeking, through test and suggestion, toys that would help physical development of the young child.

These toys appeared bare and primitive when compared with the bright and detailed toys in imitation of adult articles, so that mainly preschools bought

them.

> A little four-wheeled cart which was just a block of wood with four holes in it, and oblong, did not suggest anything owned or used by an adult, at least to the mind of an adult; but it suggested much to the mind of a youngster. A wagon was a wagon, if it had four wheels, and it could, with the aid of imagination, be an automobile, a truck, or a fire engine (McClintock, 1961, pp. 425-426).

With everyone on the move in the twentieth century, with babies in carriages, then strollers and Taylor Tots, the desire for tricycles, pedal cars, wagons, bicycles, and other wheel toys, was inevitable.

Toys of the modern era have been scientifically classified according to the nature of the different functions they perform. Some of these functions are: amusement, play for developing the child's senses and muscles, cultivation of his aesthetic inclincations, formations of his character and personality, and the building of correct attitudes and relations towards his family, his companions, and the society in which he lives and moves. All these functions are important to the child in his early, impressionable years (Dongerkery, 1954, p. 57).

The history of wheel toys indicated the evolution of toys, and their growing importance to a culture which has become very complex. The search for toys which meet the child's needs and suit the changing culture, continues in part, in this study.

The Responsibility of Toymaker and Parent

In creating or selecting a toy, the adult should be careful to choose a toy that is not an exact copy of the world as he sees it, but allow room for the

yet-developing child to make adjustments in terms of the ongoing mysterious, almost magical, and non-rational forces which exist in children as the basis of their capacity for creativity. The adult must wake up his aptitude for creative insight which he has allowed to wither away for want of use (Hils, 1961, pp. 7, 32, 37).

In creating or choosing a toy, the adult should be guided by the needs of the child, otherwise the toy might be unsuitable. The adult should attempt to seize upon the significance of what the child is telling him, studying him unobstrusively--seeking dormant aptitudes which are struggling for development. With such assistance the child may develop a well-rounded personality, be of broader mind and interests, and be much more capable to live a richer and more rewarding life in the narrow specialization of our time. As a result of being allowed to play creatively, the child is almost certain to be filled with a rich sense of liberty and confidence which shows forth in a glow reflected from within, rather than falling victim to an obscurantism of selfish and greedy materialism (Hils, 1961, pp. 7, 14-15, 69).

According to Dongerkery,

> As the child grows older, the toys with which he plays provide him with greater opportunities for his creative impulses, his fancy and imagination. As he begins to associate with other children his age, the child becomes less self-centered, and instead of deriving pleasure from playing with toys by himself, he prefers to share them with his companions, which leads to a love for games and sport which characterizes the adolescent (Dongerkery, 1954, p. 57).

The investigator, in creating a toy for preschool children, attempted to employ, to the best of his ability, an awareness of his responsibilities to the

child.

Toy Design

Children vary considerably in physical size and performance abilities at any one age; therefore, the right toy at the right time will vary from child to child at any particular age. Observing children and listening to their needs and desires can be helpful in toy design.

Since size is not too important in small toys, the dimensions are optional. However, with larger toys the designer must work with the actual physical size of the child, allowing for growth. A maximum of three years of use usually can be planned for most toys, and larger transportation toys will serve as long as they are large enough, even through grade school (Cherner, 1954, p. 23).

Toys which approximate the things parents use every day are a means of bringing the child closer to the adult world. A child releases his energy with abandon when playing with these large toys as they add reality to imaginative play. The larger and more technical the toy, the more intriguing it becomes, especially for the boy. Size, however, must be considered in relation to the area of play. Toy intricacy is related to the child's physical and motor development, his coordination and social-psychological development. If equipment offers too much challenge the child will avoid using it until he feels more capable (Cherner, 1954, p. 43).

Considering space requirements, boys especially prefer to play out of

doors where adult restrictions are likely to be less, where they have leg room and can move about more as they please. Being more energetic and less disciplined than adults, boys have difficulty remaining in one small area. This is apparent from the time a child begins to crawl. For girls, their play and toys tend to be in one orbit, for "to her, the mother with her round of household duties will always be the model for her play until the end of her childhood" (Gröber, 1928, pp. 4, 35).

Dongerkery stated:

> Children do not ordinarily care for a highly finished or costly toy. They ask for something which represents a personality or an idea with force and vigor, no matter how crudely, for anything that may be lacking in its artistic value or suggestiveness is supplied by their lively imagination (Dongerkery, 1954, p. 63).

Considering design, the toymaker cannot do better than to make his own patterns and designs in form and color, for originality and novelty are in great demand in toymaking. The need for fresh ideas in really creative toys makes for great demand (Foley, 1962, p. 118).

To facilitate progress, the use of graph paper with 1/4 inch squares is useful in making working drawings. A full-size drawing on wrapping paper will give an idea of the appearance of the toy. Modification will evolve as a clearer idea of its purpose and use is gained (Cherner, 1954, p. 24). The factors regarding toy design in this section are to be considered in the toy design for this study.

Toy Construction

Because children inflict terrific punishment upon favorite toys and games, the builder of wooden wheel toys should use hardwoods such as maple, birch, oak, or cherry because of their durability. The opinion seemed to be that the younger the children, the greater the variety of tests they are apt to apply, such as: chewing, sucking, gnawing, pounding, throwing, and kicking. Soft woods such as pine, spruce, redwood, or hemlock should be avoided because of softness or splintering qualities. All surfaces should be sanded smooth and any corners rounded to prevent injury. Any removable elements should be too large for swallowing, and all moving parts should be fastened securely (Pelton, 1951, p. 1).

Where plywood is to be used, the waterproof type will serve best if the toy is to be used outside. In addition, plywood is extremely strong, due to its layers of opposing plies glued together. Fir plywood is satisfactory for most toys and is the least expensive (Lawson, 1953, p. 18).

In building toys, wood is an excellent material and parts should be joined with nails or screws, and in conjunction with glue if added strength is desired. A waterproof type is best. When gluing a joint, a film of glue should be applied to each surface and let dry, followed by another film and clamping the parts solidly together when the glue becomes tacky. Although a mitre joint is probably most attractive, a butt joint is quite satisfactory (Lawson, 1953, p. 20).

Though new paints and methods are invented every day, apparently no paints available to the consumer are completely non-toxic. The manufacturers

of children's cribs have a specially made paint which is baked on, not available to the home toymaker. However, any good enamel will be satisfactory if the child is past the chewing stage. Paint should be thoroughly dry before giving the toy to a child. Outside paint should not be used because it chalks off, that is, it is deliberately made to shed in order to keep clean (Lawson, 1953, p. 22). The hardness of the final paint film is in part dependent upon the application of a suitable undercoater. Light sanding between coats improves adhesion (Pelton, 1951, p. 9).

During recreational periods, both children and adults are partial to bright colors, the primary colors being least confusing to the very young.

> A psychologically trained toymaker knows what colors are acceptable to each particular age. The young child likes its colors very bright and definite, the older child will begin to prefer more natural colors (Hils, 1961, pp. 31, 56).

When several colors are used, each color should be allowed to dry thoroughly before applying the next color. Because of its toughness and high weather resistance, a final coat of good spar varnish makes a more durable finish. These suggestions for toy construction shall be considered in the building of the research toy.

Research on Children's Play

A search of the literature for studies involving preschool children and their play with toys, indicated that few such studies had been made. The literature abounded with articles on how to make some particular toy, but involved

little study of toy use. A large number of reported studies used toys as a means of studying various personality traits, such as masculinity-feminity, aggression-submission, and identification. Other studies used toys in aspects of play therapy for diagnosis or treatment.

Two studies were found which reported experience bearing on the present study. The first (Patrice, 1950), was that done by Sister Jean Patrice for the Sifo Company. Sister Patrice, a kindergarten teacher, tested a toy block city with children aged three, four, and five years. The testing lasted fifteen months, and was done in a free play situation.

The three-year-olds enjoyed the colors and the tactile experience. They enjoyed recognizing houses and other buildings, but could not plan a city on the large canvas street layout. It appeared that almost any set of blocks would have sufficed.

The four-year-olds had difficulty deciding where to put all of the buildings. They were interested in the cars and the imaginative element of the play and would name their neighbors and assign houses to them.

The five-year-old children manipulated the toy, consulted with each other about locations of buildings, made rules based upon observations and experience--thus discovering their own needs in terms of traffic laws, respect for another's property, and other aspects of good citizenship. They also became acquainted with community helpers, such as firemen, policemen, and milkmen, and repeatedly dramatized their functions (Patrice, 1950, pp. 11-12). Though the study made no mention of testing procedures, the age groups, play situations,

and some of the aims were somewhat comparable to the plan for the present study.

The second study was done by Harold Benjamin (1932) on toy preferences of children from two to six years old, in terms of sex and age choices. The research took place in each child's home and was standardized. The children were tested singly and toy choices were measured in terms of total time played, plus a choice at the end of the 30 minute play period, where the child was given the toy he liked best. One hundred subjects were selected, who, if they had attended any preschool at all, had attended kindergarten only.

The results of the study indicated that though car was a significant masculine toy choice, airplane had virtually as strong a following among the girls as among the boys. The participation among the girls was well-distributed through all age groups, and the test choice between boys and girls indicated airplane as significant for both sexes. Further, the choice of airplane for the girls was almost as significant as the feminine choice, doll (Benjamin, 1932, pp. 417-429).

The Benjamin study was comparable to the present study in terms of age of subjects, and sex choice or preference of toys.

The next chapter, Chapter 3, is concerned with procedures, including: (a) construction of toy, (b) the child and the toy, (c) the subjects, (d) the play situation, and (e) method of data analysis.

Chapter 3

Procedures

Construction of Toy

Philosophy and Use

Through the ages, many toys have had wheels, yet the literature surveyed did not indicate a toy such as the one that was designed for this study. A picture was found of a horse fastened inside a narrow, rolling hoop (Foley, 1962, p. 136). Similarly described were horses and dogs in metal hoops (McClintock, 1961, p. 224). These toys were rolled on the ground, either by hand or with a stick, and were not intended for riding.

The researcher began not with a toy in mind, but with a number of things that a toy could do for preschool children. A design was sought which would help to develop: (a) leg, torso, shoulder, and arm muscles; (b) awareness of physical and psychological risk-taking and control over dangers; (c) many senses of achievement and confidence; (d) sense of trust and cooperation among players; (e) coordination of muscles in conjunction with each other and with sight, hearing, and sense of position; (f) senses related to color and form, touch, weight, sound, distance, movement, and function; (g) fine muscles; (h) curiosity and creativity; (i) sense of freedom; and (j) sense of fitting into the aspiring quest in life.

The researcher wanted the toy to have as many uses as possible, yet have a simplicity of design, which, when viewed with a single perspective, would be seen to have one use at a time. Particularly, the researcher had in mind a toy to be used in the preschools, during this particular stage of a child's development, a toy that teachers might use easily and with confidence.

The toy's durability and economy of construction were factors, as well as attractiveness, pleasure in use, and use in conjunction with other toys. It was hoped that the toy would be suitable for indoor play, for many children are indoors much of the time, especially during the winter months; and it was hoped that the toy also might be used outdoors.

Various designs came to mind and were rejected. The present design was held in abeyance for some time, as the researcher reviewed the possibilities of building into it characteristics which would satisfy as many of the developmental needs of preschool children as possible. In fact, after the toy construction was begun, additional characteristics were added.

The finished design was essentially a rolling cylinder with wheels at each end, integral with the cylinder. The researcher anticipated that:

1. This much of the design would provide, for the children who used it, an opportunity to develop leg, torso, shoulder, and arm muscles as they rolled the toy back and forth.

2. Inside the toy, a rider could develop muscles as he crawled in or out, and as he held his position when he was rolled.

3. By deciding to ride inside, the rider could be aware of risk-taking,

both psychological and social, with a hint of physical risk.

4. Upon the completion of his ride he would feel a sense of achievement and confidence, as well as a sense of trust in those who had cooperated in rolling him.

5. The rollers could develop a sense of achievement and desire to ride and achieve.

6. Coordination of muscles in conjunction with sight, hearing, and sense of position could be achieved by the rollers and the rider as the toy was rolled over a span of floor, and as the toy changed position.

7. The senses related to color and form, touch, weight, sound, distance, movement, and function could have been exercised as the toy was viewed and moved.

The toy was colorful--the wheels glossy black, the body glossy brown, the interior a leatherette persimmon color. The exterior top panels had three basic colors, white, yellow, and a small accent of brilliant pink. There were several integrated pieces of natural finished mahogany on the door, which was part of the top panels.

On the back panel was painted a white-trunked birch tree with grass at the base; on one side panel was painted a cat with green eyes and a long, curling tail, all in yellow and brown; and on the other side, a dog, also in yellow and brown.

The hand holes in each wheel were accented with the same brilliant pink, and the triangular-shaped port holes at the head had white frames against

the brown body. The two holes near the center, for assisting with the safety belt, were edged in yellow against the brown body. Two hand dials at either end--with numerals and letters--were painted bright red and bright green.

The researcher anticipated that:

1. Fine muslces could have been developed by turning the hand dials on the outside as well as the two dials inside the toy, which also rotated with the movement of the toy.

2. Fine muscles could have been used in buckling the safety belt about the waist, and in operating the two cabinet catches on the door. (Two catches were used to help guarantee thoughtful opening of the door, and to aid in hand coordination.)

3. Senses of curiosity, creativity and freedom could have been exercised as the toy was viewed and used.

4. A sense of aspiring could have come not only from the child's own immediate-use-sense, but also from a bridging into the adult world via many imaginative ideas related to equipment and roles in our culture, such as: autos, trucks, tractors, bulldozers, ditchdiggers, graders, submarines, various boats, airplanes, and underwater exploring devices. (Others, which the children suggested, are related in the section on Toy Use in Chapter 4.)

The toy not only could be used in a rolling position, but also in an upright position, which multiplied its uses. In this position children could climb on top of it and could manipulate their bodies into small and complex spaces as they crawled into it and closed the door. They could bring other toys into conjunctive

use with it, (blocks, etc.), use the back side as a symbolic tree, or play visual tag through the several openings.

Structural Design

Because the toy needed to be strong but lightweight, fir plywood was selected as the basic material. The wheels (28 inches in diameter) were made of one-half-inch plywood, the rectangular body panels (45 inches in length and varying in width from 14 inches to 18 inches) were made of one-quarter-inch plywood.

The bottom panel of the center section was shaped in a V form to provide a comfortable couch; the shape also tended through centrifugal force to keep the child centered in the toy. This bottom section was heavily upholstered into a form-fitting couch for the rider. The rest of the interior was upholstered with a lighter foam plastic, and the entire interior was covered with a heavy leatherette plastic cover.

Weight distribution was considered in the toy's design, so that when a rider was inside, there was a tendency for him to stay in a face-up position. This weight distribution made it easier to roll the toy, since a distribution of weight far off center would have made rolling more difficult. Also, if the weight distribution were significantly off center, the characteristic movement of the toy would have been a slow turn to get the weight to the top of the cycle, and then a rapid, perhaps uncontrollable, forward roll.

The researcher considered using various shaped wheels to give a particular type toy rolling movement, for instance: an egg-shaped wheel to give the type movement just described; a modified triangle to give three such fast spurts

of speed on forward movement; and a modified square to give four such spurts per turn of the wheel. But because it was necessary for the children to have the toy under control at all times, the circular wheel was used.

The wheels had tires made of split plastic garden hose, both durable and non-marking, that enabled the children to get a grip on the wheels as they turned them.

In joining the component parts, the researcher used fir quarter-round (one-inch by one-inch) for the body panels, and fir two-by-two for fastening the wheels to the body. Fir was selected because of its strength and lightness. All single component parts were glued and nailed, and the resulting components were assembled with wood screws. Rubber cement was used for the interior padding and covering.

Concurrently with the toy's evolution, hand dials were built of large buttons glued together. Small washer fasteners were welded to the hinge rod, then the two noise-makers were assembled (one, a circular tube with B-B's inside, the other a straight tube with a large, headless nail within).

The painting was also done prior to final assembly. A primer was used, followed by two coats of interior-exterior enamel. A final coat of tough synthetic varnish was applied after the figures had been painted on with enamel. The separate coats of paint were heat-dried by an electric heater, to assure a hard, dry finish before the toy was put into use. It weighed 40 pounds (Appendix A).

Safety Design

With all toys there are safety hazards. The researcher attempted to eliminate all hazards beyond the control of the children. The toy was designed from physical measurements of the age children involved in the study. The interior of the riding compartment was designed so that different size children could brace themselves with hands and arms. This was accomplished by varying the proportion of measurements in the arm area, and the leg area. The overall measurements of the toy were such that riding children would have their heads, legs, and feet protected. The head was back of the top opening, and the feet were inside at the other end (Appendix B).

The toy was designed so that the rider rode with legs drawn up and knees pressed against the top of the riding compartment. Dimensions were such that hands were braced against the top of the compartment, and the head could not be outside the compartment, nor sustain a bump against any part except the padded interior.

A safety belt at the waist kept the body centered into the V of the riding couch. The opening above the head was offset so that it was not directly over the eyes, and the two triangular port holes on each side of the head were covered with heavy mesh wire to prevent injury to the head (by another child who might thrust a hand or other object into the interior). When the toy was used in the rolling position a safety bar was attached to the door to prevent its being opened.

There were a number of ways in which a child might have been hurt with the toy: a foot might have been run over, a child might have been run into

by the toy, a child might have gotten his finger pinched in the door, a child might have fallen off of the toy when it was in the vertical position. Such types of accident are unavoidable with toys, but with adult help and through experience children quickly learn how to avoid them. Each play session in the research involved a brief resume of safety.

The researcher had an opportunity to observe a very small child and a medium size child riding in the toy without the aid of the safety belt. (They insisted on not using it.) The children rolled the toy at a normal speed; the researcher was at floor level observing. In both cases the children rode without danger, their bodies being centered by the V shape of the riding couch, their arms and legs effectively bracing them. On other occasions, the researcher observed different sizes of children riding in the toy, with the aid of the safety belt, but not using legs or arms for bracing.

As a result of the inherent design, the rider cannot control the direction of the toy's movement. He is dependent upon those who roll him. The toy should not be used on a sidewalk where it could roll into the street. With preschoolers, it should not be rolled down a steep hill, since the ride might be frightening, or the toy might bump into something. As with any preschool wheel toy, this toy should be teacher-supervised.

The Child and the Toy

The Child Inside The Toy

The researcher anticipated that:

1. Children would experience the toy environment as new, strange, yet interesting, and inviting.

2. Each child would strap himself in, with help if necessary.

3. With legs and arms in position, with the comfortable couch beneath him, with his friends nearby, with an air of expectancy, the rider could signal his readiness to go.

4. As the rider rolled in the toy he could see the familiar room change aspect, that he could feel his body change position, that he could exert his muscles to maintain his position.

5. The rider could hear the sound of the toy noise-makers as the toy turned.

6. The rider could see and hear his friends who were rolling him, and be aware of their interest as they might ask him about his ride.

7. At the end of the ride, the rider would perhaps join those who had rolled the toy, expressing himself in the action of movement.

8. As the result of experience with the toy, the child could have new perspectives of his environment and of himself.

9. Through observing the toy he could discover how it worked, think about it, turn the dials, become familiar with numerals and letters, and become friendly toward those with whom he had cooperated to make it go.

In the vertical position, except for movement, it was anticipated that:

1. The child could experience many of the former experiences when he was inside the toy.

2. He could also have the opportunity to climb into and out of a different, small, complex space.

3. He could strap himself in, and turn the dials before him.

4. He could climb up through the cylinder and stand on the interior supports, looking out over the group.

5. He could evolve many imaginary roles for himself.

The Child Outside The Toy

Outside the toy, the researcher anticipated that:

1. The child would have opportunities to develop large and small muscles by rolling, pushing, manipulating the dials, running and jumping beside the toy.

2. He could experience social interactions.

3. He could observe proper habits in play, learn to share, and to anticipate predictable happenings.

4. He could learn to be aware of the rider, who would be affected by what was done outside.

In the vertical position it was further anticipated that:

1. The toy would offer the child an opportunity to develop the muscles used in pulling up on top of the toy.

2. The child would have an opportunity to sit around the top of the toy and enjoy the feeling of being up high.

3. Children would use other toys, such as blocks used in building a city, in conjunctive play with the toy.

The Subjects

Age and sex were the only selected factors relating to the subjects. By inspection, other desirable factors were observed to be present. Some of these were: individual variability of physical size, psychomotor development, personality, and social conditioning.

The investigator decided to test the toy with preschool children--three-year-olds, four-year-olds, and five-year-olds. The two younger groups selected were enrolled in the University of North Carolina at Greensboro Nursery School. The five-year-old group was enrolled at the St. Francis Episcopal Church Kindergarten in Greensboro. Each age group was composed of twelve children, six boys and six girls.

Physical Setting

The research setting in all cases was the children's regular classroom. The rooms were comparable in terms of: ample space; good lighting; unobtrusive wall, ceiling, and floor colors; low window height; safety factors; smooth tiled floors; movable furniture; ample toys and creative materials; temperature control; access to halls and bathrooms; and in-the-room wash-up sinks. All wheel toys which were usually used outside were excluded. There was no comparison of the research toy to any other toy.

Data Collection Schedule

Each research group had three play sessions of 30 minutes each with

the toy. A thirty-minute introductory play period preceded data collection by three days. Data collection periods followed a preset pattern for all groups, the periods were from 9:30 to 10:00 a.m., and 10:30 to 11:00 a.m. No change was made in the regular school program.

Toy Presentation

In the introductory period the children were told about the safety precautions for the toy and that it had two play positions, vertical and horizontal. They played with the toy in both positions.

At the first research session the toy was presented in vertical position; the second day, in horizontal position; and the third day on a free choice basis, so that the children could choose any position they wished, to start their play. At any time, during any period, they understood that they could change the position of the toy by asking their teacher, and they did.

The Play Situation

Introductory Play Period

In the introductory play period, the researcher brought the toy in, allowed the children to come close, touch the toy, look at it, and express their opinions and ideas. Then, through a questioning technique, the researcher asked the children how they might use the toy, and demonstrated as they expressed their ideas. In this way, safety measures and the general use of the toy were discussed. The researcher told the subjects that they would be free to

use the toy in any way they chose, and that any time they wished to change its position, they should ask their teacher to help them change it.

The children were free to use any of the toys in the playroom in conjunction with the toy, but this was not mentioned--only that they could play with the toy as they wished. The children played and were notified two minutes before the period ended that the play period would soon be over. At the end, the researcher told the children he would return on a particular day. While the children played, the teacher and researcher stood by.

Research Play Sessions

The research play sessions were conducted in the same manner as the preliminary sessions, with a brief safety introduction period as the toy was set up. The children were told again that the toy position could be changed at any time. The children immediately put the toy into play as the observation periods began.

Teacher Role

A week prior to beginning the study, the researcher met with the teachers and discussed the objectives, including the teacher's role, which was: (a) to allow the children to use the toy in free play; (b) to cooperate with the children's desires for changing the position of the toy; (c) to suggest to the children no name nor use for the toy; (d) to assist the children in sharing the toy; and (e) to assist the children in terms of safety. An instruction sheet, covering all aspects of the study, was left with each teacher (Appendix C).

Researcher Role

The researcher's role was to: (a) introduce the toy in its selected position; (b) give brief instructions regarding safety; (c) inform the children that they could change the toy's position at any time; (d) fill in the preliminary sections of the diary data collection sheet; (e) observe and record the participation; (f) terminate the session; and (g) remove the toy.

Pretest of Toy and Diary Data Collection Sheet

The subjects for pretesting the toy were two groups of children enrolled in the Holy Trinity Episcopal Church Nursery School and Kindergarten, Greensboro, North Carolina. One group was composed of four-year-old children, the other of five-year-olds. There were two sessions for each pretest group, an introductory period, and a trial play and record-keeping period on separate days, each lasting 30 minutes. The diary data collection sheet was found to be unworkable, so it was revised (Appendix D).

Method of Data Analysis

Hypotheses

The hypotheses tested were:

Hypothesis 1: There will be no significant difference in the amount of time that nursery school and kindergarten children use the toy.

Hypothesis 2: There will be no significant difference in the amount of time that boys or girls use the toy.

Hypothesis 3: Children's preference of the position of the toy (vertical or horizontal) will not vary significantly in terms of time used.

To determine the results of the data in relation to the hypotheses, the mean time, and standard deviation for the total group of children, for the three age levels, and for boys and girls within each age level were calculated.

To determine the statistical significance of the absolute differences which did occur, the Mann-Whitney Two-Tailed U Test (a non-parametric test) was used (Siegel, 1956, p. 120).

The following chapter is concerned with the results of the study.

Chapter 4

Results

Objectives

The objectives of this study were (a) to create an educational toy for preschool children, and (b) to study its use with children three, four, and five years old.

How the children would use the toy provoked several questions: (a) How much of the time will the toy be used for play out of the total time available? (b) Will older children use the toy more than will younger children? (c) In terms of time, will boys and girls differ in their use of the toy? (d) Will the children prefer to use the toy more of the time in a vertical or in a horizontal position?

Previous chapters detail various aspects of awareness essential to the creation of a preschool toy. A plan was devised to study the use of the toy. Details are described in the section on Procedures.

Hypotheses

The hypotheses for the study were:

Hypothesis 1. There will be no significant difference in the amount of time that nursery school and kindergarten children use the toy.

Hypothesis 2. There will be no significant difference in the amount of

time that boys or girls use the toy.

Hypothesis 3. Children's preference of the position of the toy (vertical or horizontal) will not vary significantly in terms of time.

The different uses of the toy by the children were considered valuable (toy use was equivalent to how a child conceived the toy as he was using it). It was surmised that children might use other toys in conjunction with the research toy. They did, and these data were recorded.

The first question to be investigated was, how much of the time will the toy be used for play out of the total time available? The data from the diary data collection sheets are reported in summary form in Table 1, which indicates that in all play periods the toy was in use by one or more children. Thus the toy was in use 100 per cent of the time, though all children were not involved in using the toy at any one time.

The second question to be investigated was, will older children use the toy more than will younger children? Table 2 reports, in summary form, data collected on the diary data collection sheets, including minutes played, mean time, and standard deviations.

From Table 2, it is observed that amounts of time played by boys and girls, from three-year-olds to five-year-olds, did vary. Although these were absolute differences, it was necessary to determine whether such differences as did occur, were significant. The Mann-Whitney Two-Tailed U Test (a non-parametric test) was used. The results are reported in Table 3.

An inspection of Table 3 reveals that all differences of total time

Table 1

Percentage of Time Available that Toy Was Used By Age Levels

(All Periods)

Age group	Minutes toy available	Minutes toy used	Percentage of time toy was used
3 yr. olds	90	90	100%
4 yr. olds	90	90	100%
5 yr. olds	90	90	100%
All children	270	270	100%

Table 2

Total Minutes Played, Mean Time, and Standard Deviations
By Age and Sex

(All Children)

Age group	Boys			Girls			Boys and Girls		
	Minutes played	Mean time	Stand. dev.	Minutes played	Mean time	Stand. dev.	Minutes played	Mean time	Stand. dev.
3 yr. olds	218	43.6	20.85	189	31.5	21.56	407	37.0	22.08
4 yr. olds	231	38.5	15.57	238	39.7	17.03	469	39.1	16.34
5 yr. olds	336	56.0	17.38	206	34.3	14.22	552	45.2	19.58
All children	785	46.2	19.55	643	34.6	17.9	1428	40.5	19.72

Table 3

Significance of Differences Between Time Played
By Different Age Groups

(Mann-Whitney Two-Tailed U Test)

Age groups	U value	Significant at .05
3 and 4 yr. olds	45	N. S.
4 and 5 yr. olds	32	N. S.
3 and 5 yr. olds	40.5	N. S.

played for all groups were not significant. Therefore, the hypothesis, there will be no significant difference in the amount of time that nursery school and kindergarten children use the toy, is supported. The amounts of time played by the three age groups indicate interests in the toy which did not differ significantly.

The third question to be investigated was, in terms of time will boys and girls differ in their use of the toy? Table 4 reports the probability of these differences being significant.

Table 4 shows that although differences of time played by boys and girls were present, they were not significant in any of the categories. Therefore the hypothesis, there will be no significant difference in the amount of time that boys and girls use the toy, is supported.

The fourth question to be investigated was, will children prefer to use the toy more of the time in a vertical or in a horizontal position? Table 5 reports the time that the toy was used vertically or horizontally, mean time, and standard deviations. These data, taken from the diary data collection sheets, are in summary form.

To determine the significance of differing amounts of time played while the toy was in vertical or horizontal position, the Mann-Whitney Two-Tailed U Test was used. The significance of the U values appear in Table 6.

With the exception of two age groups (four- and five-year-old children), all U values in Table 6 were not significant. For those groups having non-significant scores, the hypothesis, children's preference of the position of the

Table 4

Significance of Differences Between Time Played
By Different Age and Sex Groups

(Mann-Whitney Two-Tailed U Test)

Classes	U value	Significant at .05
3 yr. old girls and 3 yr. olds boys	4.5	N. S.
4 yr. old girls and 4 yr. old boys	17.0	N. S.
5 yr. old girls and 5 yr. old boys	6.0	N. S.
All girls and all boys	142.5	N. S.

Table 5

Totals, Means, and Standard Deviations Toy Was Used Vertically or Horizontally By Age and Sex

(All Children)

Classes	Minutes toy used vertically	Mean time	Stand. dev.	Minutes toy used horizontally	Mean time	Stand. dev.
Boys						
3 yr. olds	69	23.0	16.30	72	26.0	13.64
4 yr. olds	68	11.3	5.05	160	26.7	14.42
5 yr. olds	207	34.5	14.98	130	21.7	23.22
All boys	344	22.9	16.43	362	24.1	11.65
Girls						
3 yr. olds	83	13.8	9.51	96	19.2	9.66
4 yr. olds	76	15.2	6.32	154	25.7	13.31
5 yr. olds	109	27.3	2.68	62	15.5	6.18
All girls	268	17.9	9.54	312	20.8	11.40
Boys and girls						
3 yr. olds	148	16.3	13.39	185	23.1	13.03
4 yr. olds	154	14.0	5.47	314	26.2	13.90
5 yr. olds	316	31.6	11.86	192	19.2	7.53
All boys and all girls	612	20.4	13.15	674	22.5	11.59

Table 6

Significance of Differences Between Time Played When Toy Was Used Vertically or Horizontally By Age and Sex

(Mann-Whitney Two-Tailed U Test)

Age groups	U value	Significant at .05
3 yr. old boys	4.0	N. S.
3 yr. old girls	9.5	N. S.
4 yr. old boys	7.0	N. S.
4 yr. old girls	10.0	N. S.
5 yr. old boys	9.5	N. S.
5 yr. old girls	10.5	N. S.
3 yr. old children	25.0	N. S.
4 yr. old children	27.5	S.
5 yr. old children	20.0	S.
All boys	94.0	N. S.
All girls	98.5	N. S.
All children	.954*	N. S.

*U score was converted to a Z score because of the size of the group.

toy (vertical or horizontal) will not vary significantly in terms of time used, is supported. These groups indicated (by the scores in Table 5, and Table 6), that they did not prefer either toy position to a significant degree.

However, from data found in Table 5, and Table 6, it is apparent that for four- and five-year-old children, the null hypothesis must be rejected. From Table 7 (a selected portion of Table 5, which is reproduced for ease of comparison), it is evident that the two age groups preferred the toy in opposite positions.

For insight into how the toy was used in either vertical or horizontal positions, Table 8 indicates the uses of the toy by different age groups. Toy use was synonomous with how a child conceived the toy as he was using it. In all periods the researcher recorded spontaneous vocal and physical behavior which would indicate toy use; and in the second and third play periods, elicited vocal indication by asking children playing with the toy, "What does it seem like to you?"

Often when the researcher asked the children what the toy seemed like to them, they had no ready answer, or perhaps wanted to keep their thoughts to themselves. They often had a quizzical or evasive attitude, seemingly not wanting to be interrupted in their play.

The questioning was done quietly and personally. Out of each thirty minute play period of the second and third sessions, a total of about five minutes was devoted to this line of questioning. A single answer was sought and the encounter was very brief.

Table 7

Minutes Toy Was Used Vertically or Horizontally for

Age Groups Showing a Significant Difference

Age group	Minutes used vertically	Minutes used horizontally
4 yr. old children	144	314
5 yr. old children	316	177

Table 8

Uses of Toy by Age Groups

Spontaneous or asked	Toy use category	Toy position, vertical or horizontal	Toy use interest by age groups 3 yr. olds	4 yr. olds	5 yr. olds
S	Space ship	H	Popular	Popular	Popular
S	Chimney	V	Popular		
S	Christmas tree box	V	x		
S	"I can reach the sky!"	V	x		
A	Number machine	V	x		
S	Jail	V		Popular	
S	Elevator	V		Popular	
S	Toy robot	V		x	
S	Rocket	H			x
S	Water meter	V			x
S	Car	H			x
S	Airplane	V			x
S	House being robbed	V			Popular
A	Parachute	V			x
A	Devil with eyes	V			x
A	Fun	V			x
A	Space man	H			x

Note.--The designation popular, indicates a use mentioned or returned to more than five times during two or more play periods.

--The symbol x, indicates a use mentioned once.

The children played with the toy in their regular classroom. They were free to bring anything in the room into conjunctive play with the toy. The three-year-olds and the five-year-olds repeatedly used chairs and blocks as an aid in climbing to the top of the vertical toy, and for standing next to the toy. The blocks were piled in pyramids, and at times were as much as four or five high. During the first play period, the five-year-olds also set up a row of chairs for children spectators while the toy was in vertical position. The objects used are indicated in Table 9.

The black hat used by the three-year-olds may have been incidental. A boy was wearing it during play time. The pillow used briefly by the four-year-olds was stuffed into the toy while it was in motion.

The table used by the five-year-olds, in conjunction with the rolling toy, was used in two ways. The children would bump the toy into the table, not too hard. Apparently it gave a definite sense of an end to the ride in one direction, and it may have had other meanings.

The second use of the table was very popular. Two or more children rolled the toy by the wheels, while several other children pushed from behind the center section of the toy. When it reached the large, low table, all children, especially those pushing on the center section, dived over the toy and onto the top of the table. With much laughing and vigor, the group would then roll it back to the starting point and repeat the play. All the time, a rider was inside. Boys, particularly, engaged in this activity.

From Table 9, it is obvious that comparatively few toys were brought

Table 9

Toys Used in Conjunction with Research Toy By Age Groups

(All Sessions)

3 yr. olds		4 yr. olds		5 yr. olds	
Toy vertical	Toy horizontal	Toy vertical	Toy horizontal	Toy vertical	Toy horizontal
Chairs	Black Hat		Pillow	Chairs	Table
Blocks				Blocks	

into conjunctive play with the toy. Perhaps if the children had had the toy for a longer period of time, they might have involved more toys.

Table 10 reports the average number of children available for play in each age group for all periods of play. Illness caused some absences; fortunately, not many.

The basic purpose of this chapter has been to present the analysis of data for the study. Chapter Five presents a summary, conclusions, and recommendations.

Table 10

Mean Number of Children Available for Play By Age Groups

(All Periods)

Age group	Number in group	Mean number available for play
3 yr. olds	12	10.3
4 yr. olds	12	12.0
5 yr. olds	12	11.3

Chapter 5

Summary, Conclusions, and Recommendations

Summary

Throughout history there has been a need for the fashioners of children's toys to design them in keeping with the developmental needs of children. With the increasing volume, force, and complexity of our culture there is a heightening need for toymakers to be aware of children's needs in toy design.

Toys should not only emphasize the needs of children, they should also include a simplicity of design so that the toy may fit into the child's personal evolution, rather than being an end in itself.

The aim of this study was to create a toy embodying positive characteristics for the child's development and to study its use with children three, four, and five years of age.

A study of children's developmental needs, the philosophy of play, the history of toys, toy design, and toy construction, was undertaken before the investigator attempted to create such a toy. Past experience with children, inventing, building, and testing, prompted the investigator not to start with an idea for a toy, but with thoughts of its benefits to children.

Children play against the oppositions of climate, location, materials, fatigue, hunger, and people. They become submerged in their play, unaware

of other factors. For children, play is their work, and while they enjoy it, they are quite business-like about it. The way in which they play becomes the foundation for more complex creative, emotional, social, and work patterns. A child's play activity is also a primary source of growth and coordination for his body and mind, and calls into action his full power of concentration and creative energy. As a result, a sense of independence, imagination, and taste develop.

At the various age levels, individual differences are common in all areas of development. Differences in the behavior of boys and girls are due to (a) differences in physiological structure and function, and (b) differences in social conditioning, the latter by far the stronger influence.

Related Literature

A search of the literature produced very few studies of children and toys specifically to determine a correspondence between children's developmental needs and toy design.

A study of toys tested with preschool children (Patrice, 1950) indicated that older children had greater ability to recognize the potential and use of a toy. In another study (Benjamin, 1932) with preschool children, it was found that pre-twentieth century toys which had become identified as to sex role, tended to continue so; whereas, a new toy, specifically airplane, was used equally by both boys and girls. The results of these studies were comparable to the results of this study. Even though there was not a significant difference in the amount of time, older children used the toy more and found more uses for it.

The construction of toys must take into consideration the factors of durability, lightness, ease in handling, and safety. The toymaker, or the adult who may choose a toy, has the responsibility to build or select toys in keeping with the needs of children. A toy should not be built, nor selected, in terms of providing a copy of the world as adults see it.

Procedures for Construction

Before designing the toy, the investigator measured a number of pre-school children to find the range of measurements for different parts of their body, necessary to the dimensions of the toy (Appendix B). These measurements were converted into two stick figures, one representing the smallest child, the other the largest child. Then, on graph paper, the dimensions of the children were related to the dimensions the toy would have to be.

Because of its strength and lightness, fir plywood was chosen as the basic material for construction. After the parts were cut out they were rounded, sanded, and finished with enamel. The toy was assembled with nails, glue, and wood screws.

Subjects and Setting

The subjects were 12 three-year-old children, and 12 four-year-old children enrolled in the University of North Carolina at Greensboro Nursery School, and 12 five-year-olds enrolled in the St. Francis Episcopal Church Kindergarten, Greensboro, North Carolina. Age and sex were the only factors controlled. The data were gathered in March, 1966.

The setting was the children's regular classroom. The classrooms were comparable in size, design, lighting, furniture, toys, creative materials, and in other factors. The children played with the research toy in a free play situation, and were free to bring any classroom toy into conjunctive use with it. All other wheel toys were excluded. The research toy was not compared to any other toy.

Pretest of the Toy

A pretest of the toy and recording instrument preceded the data collection. Four- and five-year-old children from Holy Trinity Episcopal Church Kindergarten, Greensboro, North Carolina, participated in two 30 minute free play periods.

Method of Data Collection

Each research group had a 30 minute introductory play period, followed by three data gathering sessions of 30 minutes each. The data were recorded on a diary data collection sheet in terms of the amount of time in minutes that any child played with the toy: (a) total time, (b) time played with toy vertically, and (c) time played with the toy horizontally. Comparisons between age and sex groups were made in these areas.

Data Analysis

To determine the results of the data in relation to the hypotheses, the mean time, and standard deviations for, (a) the total group of children, (b) for

the three age levels, and (c) for boys and girls within each age level, were calculated. To determine the statistical significance of the absolute differences which did occur, the Mann-Whitney Two-Tailed U Test (a non-parametric test) was used. How the children used the toy and what toys they used in conjunction with it, were also recorded.

Limitations

Some of the limitations of the study were:

1. Three- and four-year-old children had many more adults present in the testing situation than did the five-year-old children. The former two groups had two teachers, student teachers, and observers; whereas, the latter group had only one teacher present during the data collection.

2. Three- and four-year-old children experienced interference from adults, whereas, five-year-olds did not.

3. The data recorded were dependent upon the judgment of the researcher.

Conclusions

Conclusions regarding the hypotheses, participation, toy use, safety, and benefits of the toy, were the following:

1. Hypothesis 1 states that there will be no significant difference in the amount of time that nursery school and kindergarten children use the toy. The differences of time played by all age groups, were not significant. These results indicate that the children's ages did not significantly relate to the amount of time

that they played with the toy.

2. Hypothesis 2 states that there will be no significant difference in the amount of time that boys and girls use the toy. Differences of time played between sex groups were not significant. This meant that sex difference did not significantly relate to the amount of time that subjects played with the toy.

3. Hypothesis 3 states that children's preference of the position of the toy (vertical or horizontal) will not vary significantly in terms of time used. All comparisons of scores for age, sex, and toy position, were not significant, except two age groups. Four-year-old children and five-year-old children preferred the toy a significant amount of time in horizontal and vertical positions respectively.

4. Although older children played slightly more of the time than younger children, the differences were not significant. The older group discovered more uses for the toy. The number of children playing with the toy from moment to moment, and from group to group varied.

5. Three- and four-year-old boys and girls tended to play about the same amount of time. However, five-year-old girls tended to play less time than five-year-old boys. Yet data from the diary data collection sheets indicate that slightly more five-year-old girls initiated play than did five-year-old boys, but girls did not play as long.

6. Since the toy was used by one or more children at all times, it was used 100 per cent of the time.

7. In the present study, few classroom toys were brought into

conjunctive play with the research toy. It seems possible that if a group of children used the toy over a longer period of time that they might (a) bring more classroom toys into conjunctive use with the toy, and (b) evolve more uses for the toy.

8. Most toy uses were associated with the toy in vertical position, though there was no significant difference in the amount of time that children played with the toy in vertical or horizontal position.

9. As the result of the toy's inherent design, the rider cannot control the direction of its movement, and is dependent upon those who roll the toy. It should be teacher-supervised.

10. Several benefits may accrue to the child who uses the toy. He may develop: (a) the large muscles of the legs, torso, shoulders, and arms; (b) awareness of physical and psychological risk-taking, and control over dangers; (c) senses of achievement and confidence; (d) a sense of trust and cooperation with playmates; (e) the coordination of muscles in conjunction with each other, and the coordination of these muscles with the senses of sight, hearing, and the sense of position; (f) the senses related to color and form, touch, weight, sound, distance, movement, and function; (g) fine muscles; (h) curiosity and creativity; (i) a sense of freedom; and (j) a sense of fitting into the aspiring quest in life.

Recommendations

There is a heightening need for research to develop toys which incorporate in their design a consideration of the developmental needs of children. Such toys may help the physical, mental, and social development of children. Regarding possible future studies related to the present research, the investigator suggests the following:

1. Replication of the study to determine if other groups may exhibit similar behaviors;

2. Longer study periods than the one used in this study to help one to know the interrelations between children's developmental needs and toy design;

3. A study to determine whether, over a longer time span, children would use more classroom toys in conjunction with the toy, and/or find more uses for it;

4. A series of studies to learn if such a toy as the one used in this study actually does aid in the development of children in the areas of: (a) physical development, (b) psychomotor development, and (c) safety consciousness;

5. A study of the experiences and opinions of teachers whose pupils might be in a research or experimental situation, and where the relation of toy design is being studied in connection with children's developmental needs;

6. A study to determine if five-year-old girls may play more of the time with a toy like the one used in this study, if boys were not present;

7. A study of boys and girls using such a toy to ascertain the effect of type of clothing upon the amount of girl's play;

8. Studies of toy design in relation to the developmental needs of older children to explore the possibilities that more toys should be designed and tested in terms of children's developmental needs;

9. Subjects be selected so as to have a minimum of adult and other interference during the study period;

10. Studies of how the developmental needs of deprived children can be met through toy design.

Such studies might include the parents, who would participate in building toys for their children. It could involve a survey of the needs of the children, and their parents, and be followed by toys constructed and tested with groups of children. Experimental and control groups could be used to help to determine whether or not the toys were effective in helping children to develop.

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Figure 1. Toy Vertical

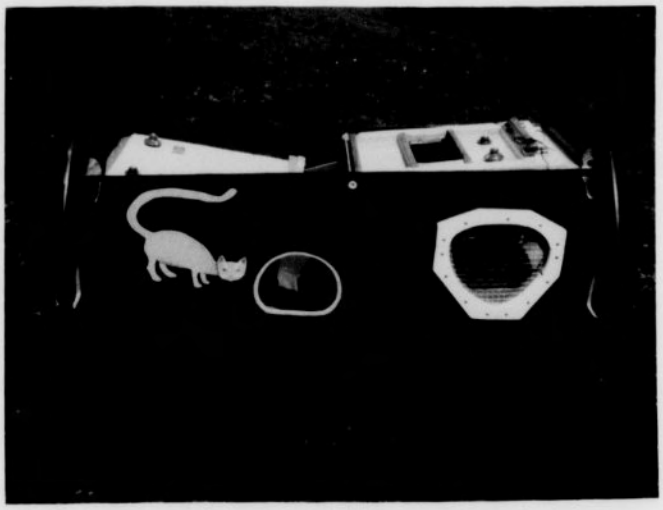
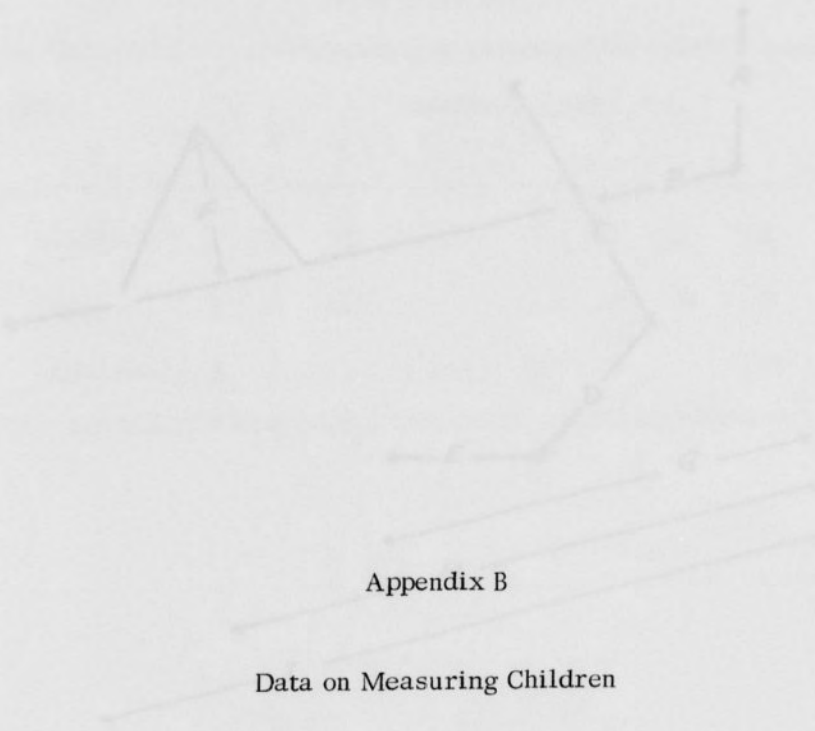


Figure 2. Toy Horizontal



Appendix B

Data on Measuring Children

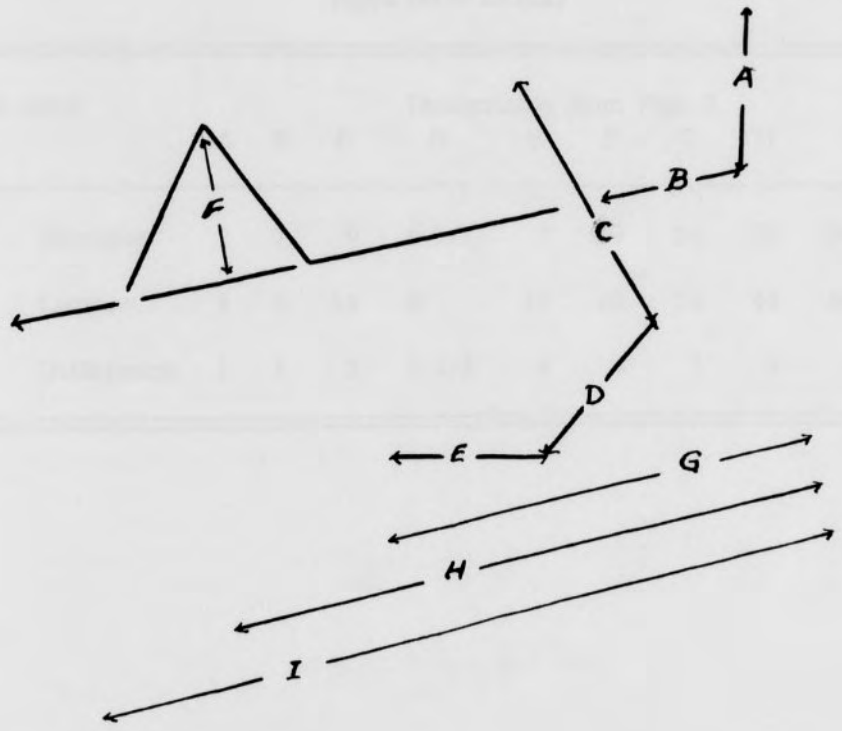


Figure 3. Measuring Diagram. Measurements taken on preschool children before toy was designed.

Legend:

A. tip of nose to back of head
B. top of head to shoulders
C. width of shoulders
D. shoulder to elbow
E. elbow to finger tip
F. floor to top of bent knee
G. top of head to bent hip
H. top of head to toe of bent leg
I. overall length

Table 11

Range of Children's Measurements in Inches

(ages three to six)

Size of child	Designation from Fig. 3								
	A	B	C	D	E	F	G	H	I
Smallest	7	7	9	6 1/2	7	9	21	33	38
Largest	8	8	11	8	11	13	24	42	46 1/2
Difference	1	1	2	1 1/2	4	4	3	9	7 1/2

Appendix C

Teacher Instruction Sheet

From: J. J. Brankey

To: (the particular school
and age group class)

Attention: The head teacher

Research plans involving the new toy

1. The researcher will bring the toy a few days before the data collection periods in order to acquaint the children and the teachers with its use.

2. If possible, it may be planned to leave the toy overnight at the school during the data collection.

3. During data collection the researcher will be taking notes in terms of three types of time use; in terms of the uses of the toy by the children in conjunction with other toys; and in terms of what the children spontaneously conceive the new toy to mean to them during play.

4. The researcher, the teachers, or other adults are not to suggest uses of the toy to the children--by giving a name to the toy, or by offering a suggested use.

5. Each morning the classroom arrangement and the position of the toy will be suggested by the researcher (so that the three research conditions may be similar) and he will be on hand to lend assistance, schedules permitting.

6. Hopefully the research will have the same number of children in each group (around 12), composed of half boys and half girls.

7. When the time for data collection arrives, the toy will be presented by the researcher, and he will take his position for recording data (near the action); and he will endeavor to devote as much effort to obtaining good data as he can, during the thirty minutes of observation. At the end of the play period, the toy will be removed, but brought back the next day until three days have passed.

8. The teacher is to cooperate with the children's desire for changing the toy from vertical to horizontal, or vice versa; and is to assist the children in sharing the toy.

Appendix D

Diary Data Collection Sheet

Diary Data Collection Sheet

Date_____ Group_____ Period_____ Avail. Boys_____ Avail. Girls_____

Weather, illness, etc. _____

Explanatory
Notes:

_____

Toys in Conj.																														
Toy Uses																														
Toy V or H																														
Minutes of Play	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
NAMES																														

Appendix E

Correspondence

Dear Parents:

As a graduate student in Child Development, I am doing some research about children's play. I am asking permission to include your child in the study.

During the regular school session, each child will have a thirty-minute opportunity (each of three days) to play with a toy which I have created. During this time, I plan to record how the children play with the toy, and how long.

I will appreciate your cooperation.

Sincerely,

Joe Brankey

From: J. J. Brankey
To: (the particular school
and age group class)

I am doing some research on children's play and respectfully request your permission to be with your group according to the following schedule:

March 7th -- 9:30 to 10:00 A.M.
" 8th -- 10:30 to 11:00 A.M.
" 9th -- 9:30 to 10:00 A.M.

The proposed indoor setting is a free play situation in keeping with your regular program plans. However, plans are to allow no tricycles, large wagons, large pedal cars, Irish Mails -- which are usually not used indoors.

The research is to involve observation of the children's play with a toy which I have created. It may be used in two positions:

1. Upright--in conjunction with building blocks, a rocking boat, costume clothes, and other play materials

2. Horizontal--in which case the toy rolls in a straight direction (if not turned about), while one to four, or maybe more children push it, with a rider strapped inside.

Note: The children will be free to use, in conjunction with the new toy, any toys which they may wish from the usual classroom situation.

A preliminary get-acquainted period is planned a few days in advance of the data collection, probably a free play period the preceeding Friday (which needs to be arranged).

Also I shall make myself available for any questions you may have, for your suggestions. A small amount of written information is forthcoming.

Sincerely,

Joe Brankey

To the Director of
(each preschool involved in
the research)

Dear _____:

Thank you and your cooperative staff for your kind assistance in helping me test my thesis toy. The data is shaping up nicely and I am grateful for the opportunity.

To the children, each one of them, I so much enjoyed being with them, and I appreciate their part in the effort.

With my kind, best regards to each and every one,

Sincerely,

Joe Brankey

Typed by Marie Teague